

Scientific Partnerships with the US Army Corps of Engineers in the Pacific Northwest

Introduction

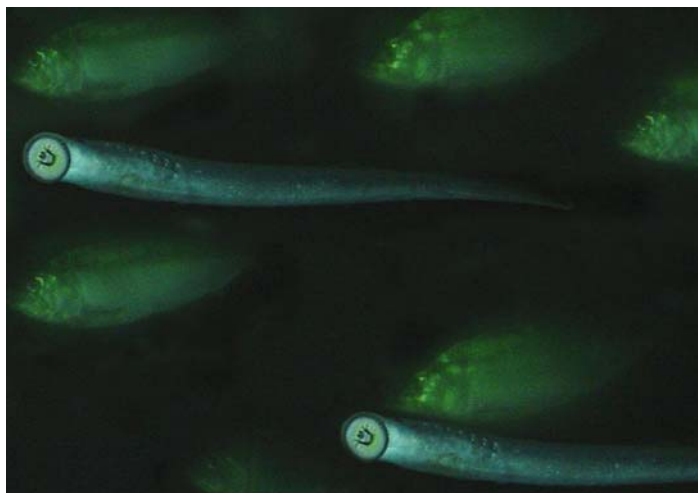
The U.S. Geological Survey (USGS) and U.S. Army Corps of Engineers (COE) have a long and productive history of research partnership and cooperation in the Columbia River Basin. The USGS, an organization with no regulatory or management mandates, is an objective science partner because it is able to provide unbiased results and technical advice on a broad range of natural aquatic resource and water issues related to federally-managed hydropower systems and regulated waterways. These environmental issues often relate to the effects and mitigation of biological impacts associated with COE projects in the Basin. The USGS-COE science partnership is founded on the development of new scientific information to monitor and assess water quality conditions, protect fish populations and habitats, and maintain other river services.

The migration and survival of Pacific salmon in regulated waterways is of major environmental concern in the Pacific Northwest. USGS scientists are addressing fish passage concerns for the COE in response to the biological requirements for operation of the Federal Columbia River Power System. For example, the Western Fisheries Research Center (WFRC) is developing new technologies for directing the movements, behavior, and health and survival of juvenile salmon at dams. Although salmon are



Paths of migrating juvenile salmon as they approach a dam.

the subject of many COE-sponsored studies, our biological research is much wider ranging and includes other anadromous fishes, such as lampreys and sturgeons, and aquatic invasive species, such as the European milfoil.



Pacific Lamprey passing Bonneville Dam with American shad in the background.

The USGS and COE are cooperators on a variety of water resource studies that include hydrologic data collection at numerous sites throughout the Columbia River Basin. The USGS's Oregon, Washington, and Idaho Districts maintain and operate 88 stage/discharge gages, 17 reservoir elevation gages, 38 temperature gages, and 16 total-dissolved-gas monitoring sites. Several long-term monitoring sites are maintained. Turbidity, dissolved oxygen, pH and specific conductance are sampled and data is available in real-time from nearly all these sites on the Internet (<http://oregon.usgs.gov/>).

Resource Management Issues

Water Resource issues are of interest to federal managers of hydropower operations because of effects on water quantity, quality and availability. These attributes directly relate to fish and wildlife habitats. With respect to fishery and aquatic resources, water quality concerns associated with the biological effects of dissolved gases and water temperature are of primary concern. Example USGS research includes:

- Investigation of water temperature effects on the migration of juvenile fall chinook at McNary Dam.
- Determination of the role of dissolved gas supersaturation and “gas bubble disease” in juvenile salmon.
- Hydrodynamic modeling at Bonneville Dam to study the effects of variable water levels on aquatic habitats and invasive species.

Fish Passage at dams, especially for anadromous fishes, is a regional resource conservation priority. WFRRC researchers are assisting the COE in the development of new technologies to improve a fish’s ability to successfully migrate past dams. The long-term goal of fish passage studies is to increase run sizes of declining fish populations. Some highlights of USGS fish passage research include:

- Estimation and monitoring of juvenile salmon survival at COE projects.
- Evaluations of prototype fish passage devices (e.g., surface bypass systems and removable spillway weirs) using multidisciplinary study approaches (e.g., telemetry, hydroacoustics, and water velocity profiling).
- Determination of the energetic requirements for migration past dams by adult salmon and lamprey.

Fish Habitats in the mainstem river are critical to populations of salmon, lamprey, sturgeon, and other aquatic species. For instance, they provide essential nursery and spawning habitats for many stocks of Pacific salmon in the Columbia River. Several examples of WFRRC studies in response to COE habitat information needs are:

- Investigation of the behavioral responses of sturgeons to disposed dredge materials in the lower river and estuary.
- Modeling effects of changing water levels on the spawning success of threatened chum salmon below the Bonneville Dam.



USGS hydrologist calibrates total dissolved gas monitoring equipment at John Day Dam.

- Bathymetric surveys of the Bonneville Pool to improve hydrodynamic modeling of reservoir habitats and distribution of invasive species.

Hydrologic Effects of reservoirs on water quality, river currents, sediment transport, and fish habitat are an ongoing focus of USGS and COE cooperative research. The cooperative efforts may have interdisciplinary applications but this research and monitoring is most relevant to understanding the physical processes and effects of water movement and storage in the regulated river environment. Some attributes of important aquatic habitats are well characterized by the water quality parameters and other physical measurements taken at USGS gaging sites. This data is being used to describe and protect the habitats of bull trout and Kootenai sturgeon in Idaho and Montana. Other examples of cooperative USGS-COE studies include:

- Detailed velocity and sediment data collection at the Lower Granite and Ice Harbor Reservoirs, ID.
- Collection of total dissolved gas and water temperature data below COE dams on the lower Columbia River since 1996.
- Remediation of trichloroethylene contamination in the groundwater beneath Fort Lewis, WA.
- Wetland restoration of degraded fish habitats from agricultural runoff (i.e., nutrients, pesticides, bacteria, and sediment) in Yakima Basin, WA.

Emerging Science Needs

The Puget Sound region is the geographic focus of federal, state, and local government agencies sharing common concerns about the effects of urbanization on coastal environments. The USGS and COE are working in cooperation with others in the planning and coordination of science in support of *The Puget Sound Nearshore Project (PSNERP)*. Prominent resource issues include coastal ecosystems and salmon recovery, forage fish ecology, marine protected areas, geohazards (i.e., earthquakes, volcanoes, and landslides), coastal morphology, sediment transport, and nearshore circulation, to mention a few. The USGS is an active participant on the PSNERP scientific planning and oversight committees. A broader, more comprehensive science plan for Puget Sound is being developed by the USGS which, when implemented, will support and complement the PSNERP effort.

For additional information, please contact:
Lyman Thorsteinson, Center Director
U.S. Geological Survey
Western Fisheries Research Center
6505 NE 65th Street
Seattle, WA 98115
Phone: (206) 526-6282
FAX: (206) 526-6654

or:
Dr. Dennis D. Lynch, District Chief
U.S. Geological Survey
Water Resources Discipline
10615 S.E. Cherry Blossom Dr.
Portland, OR 97216
Phone: (503) 251-3265
FAX: (503) 251-3470